

and another sheer descent of 100 feet to develop more electric power; then on again 16 miles to a third power plant, finally to find freedom in the San Fernando reservoirs.

These two basins perched on the rim of the San Fernando valley will look down 1000 feet upon Los Angeles, 20 miles away, and a score of other towns and cities of the Pacific coastal plain. No pumping is anywhere necessary. The only expense will be that of maintenance, which should be small because of the enduring character of the materials employed in the construction.

From the intake, at an elevation of 3800 feet, the water of its own gravity will flow with gentle velocity, excepting at points where power is developed, to the impounding basins at the lower end, and will there be drawn off for irrigation and domestic use.

The size and shape of the conduit with from the Hanwee reservoir vary greatly. Both are determined by the character of the country and the soil. The average size of the conduit is 10 feet in diameter and 12 feet in depth. With the exception of the 22 miles of unlined canal and the 38 miles of lined conduit which empties into the Hanwee reservoir, the aqueduct is covered. The lining of concrete for the conduit ranges from eight to 12 inches. The concrete slabs moulded to a covering have a thickness of six inches and are reinforced with steel. There are 22 miles of canal, 42 miles of tunnels, 15 miles of steel siphons and concrete flumes, and 127 miles of concrete-lined conduit, with 13 miles of the remaining distance made up by siphon distance. This makes a total of 230 miles from the point of intake to the lower outlet. Thence the water is carried 29 miles in a riveted steel siphon main, which will empty into the reservoirs of the city's present distribution system.

This is the Los Angeles aqueduct. A major portion of the most difficult and expensive part of the work is finished. In point of difficulty 68 per cent of the aqueduct and 46 per cent of the distance is completed.

**Work of the Engineers.**

The \$22,000,000 bond issue was voted



June 13, 1907. Immediately the portion of the plans of these engineers that called for the aqueduct excavation, but for overcoming obstacles, began to materialize. They built 225 miles of road and trail, one notable example in the Jawbone division being seven for eight miles in solid rock at a total cost of more than \$40,000. They laid 180 miles of water mains from springs far back in the mountains to the line of the aqueduct. These systems are four in number, and with reservoirs at high elevations insure a copious supply of pure water for domestic use and for the mixing of concrete. They staked the course of a standard gauge steam railroad 125 miles in length with the expectation that the city would construct, own, and operate the line. The Southern Pacific stepped in, however, and in return for the handling of the 1,000,000 tons of aqueduct freight took the transportation problem off the city's hands. The new road is completed today from Mojave to Owens Lake, and by fall will be in operation to the mouth of the Owens valley. The railroad parallels the aqueduct as far as this is feasible.

With the question of water supply and transportation out of the way, there yet remained the problems of communication and of power for the mechanical equipment. The difficulty in the first instance was disposed of by the building of a copper wire telephone system from the headquarters in Los Angeles to the intake, 250 miles north. From the main line branches ramify into each of the 100 or more camps, so that the chief is always in touch with his engineers.

The energy of two mountain streams have been utilized to furnish power. Three hydro-electric power plants generating a total of 3300 horse-power have been erected, and the electric lines carried over high-resistance transmission wires as far southward as Mojave. By this means the three dredges are driven, many of the power shovels, all the tunnel equipment, half a dozen machine shops, and a cement mill, not to mention the lighting of all the camps. The expense has amounted to one cent per horse-power per hour. To have employed steam at the high cost of fuel, not to consider the scarcity of water, would have cost ten times this amount.

**City Manufacturing Its Material.**

In the estimate of materials required, 1,200,000 barrels of cement was the principal item. Cement is a mixture of limestone and certain clays rightly proportioned, burned, and ground to an impalpable powder. Mixed with sand and gravel and water, it forms a concrete that, after being allowed to set, has the hardness of rock.

Almost midway between the intake and the outlet of the big watercourse, and on the main line of the Southern Pacific railroad, the city's engineers discovered the cement deposits for the manufacture of cement.

No city previous to this time had entered into the cement making business, but Los Angeles, undeterred, purchased the lands and began the erection of a plant. Los Angeles today owns the village of Monolith, the sole employer of the 250 laborers and skilled artisans dwelling therein with their families, and every 24 hours ships out along the aqueduct more than 1000 barrels of cement. Even at this rate the mill cannot keep pace with the unprecedented speed of building, and recourse is also had to corporation mills.

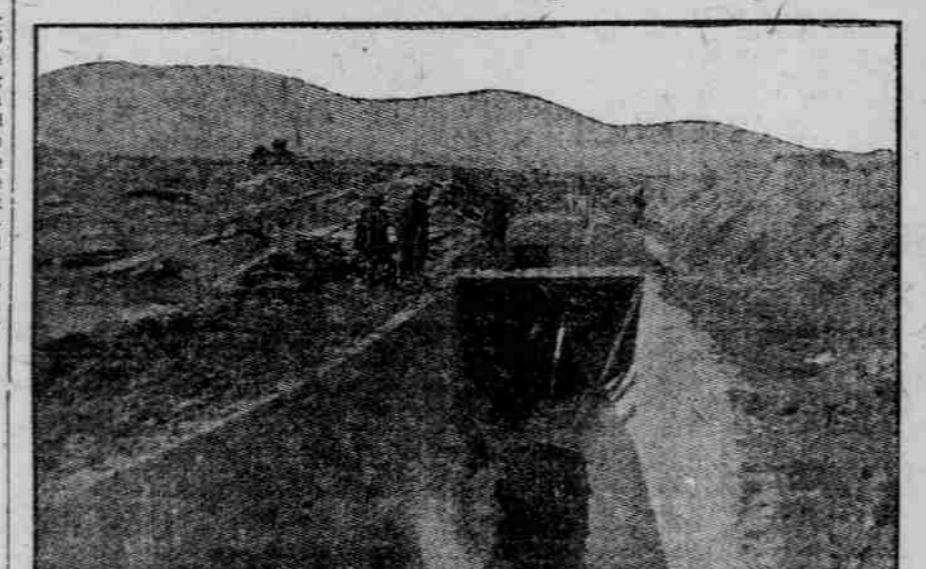
In two localities within the aqueduct zone deposits of tuff or volcanic ash have been discovered, and grinding plants have been erected at both points. The product is mixed with the Monolith cement to form a mixture stronger but closely similar to the material used by the Romans in the construction of their aqueducts 2000 years ago, and which are doing service to this day.

While this preliminary construction was in progress 15 months rolled around. In December, 1908, the Los Angeles chamber of commerce called upon the chief engineer to give a statement of how much of the aqueduct had been completed to that date.

**"Let Me Alone."**

Mr. Mulholland met the committee of this body with some trepidation. It is human nature, whether in Maine or California, for taxpayers to demand results, and these immediately. "Well," he answered, "we have spent about \$2,000,000 all told, I guess, and there is perhaps 300 feet of aqueduct built. Figuring all our expenditures, it has

## The Great Los Angeles Aqueduct



cost us about \$3000 per foot"—this defiantly. He waited for his words to sink in; then added, "But by this time next year I'll have 50 miles completed, and at a cost of under \$30 per foot, if you'll let me alone."

"All right, Bill," said the chairman. (In Los Angeles, grown from a village to a metropolis in a decade, the residents still call each other by their first names.) "Go ahead," they were not mad about it.

**Cooperation and Confidence.**

Herein is to be attributed no small part of the success of the undertaking. Mulholland has the confidence of the community. He believes in him implicitly, and he believes implicitly in him. The job and the men under him. "If Mulholland told these people he was building the aqueduct out of green cheese," said a newspaper reporter, "they'd not only believe but take oath that it was so."

The project is inseparably associated with the man and his life's work. He is now 54 years of age and is Irish by birth. At 20 he came to America. Two years later he landed in California with a fair education, a wonderfully retentive memory, ambition to improve himself, and \$10 in his pocket as his capital. His first work was in digging artesian wells. Six months afterward he accepted a position as "janitor," or ditch cleaner, for the Los Angeles City Water company. For three years he lived alone in a cabin far up in the Los Angeles river bottom. His days were passed in ditch cleaning, his nights between sleep and study. Step by step he pulled himself upward. In 1882 he was made superintendent and chief engineer of the company. He was a peculiar policy of the corporation and an inability to keep pace with the growth of the city forced the municipality, in 1902, to take over the property.

Mr. Mulholland was retained in his position, and a non-political board of water commissioners was placed in office. Under the supervision of Mr. Mulholland and these men the enterprise prospered exceedingly. Today it is one of the three most successful water works in the United States.

**The Discovery.**

No sooner was the water department upon a firm basis than Mr. Mulholland set about to seek a source of supply larger than that of the Los Angeles river. Fred Eaton, at one time superintendent of the City Water company and later city engineer, then mayor of Los Angeles, had lived in the Owens valley for 15 years. He was confident that in this cleft in the Sierra lay the city's only hope. Mr. Eaton prevailed upon Mr. Mulholland to visit the valley with him, and he returned with the conviction that Mr. Eaton had found what he himself had sought without avail. Neither the great distance nor the seemingly insurmountable obstacles could frighten him. He knew only that Los Angeles must have water to continue her existence as a city, and that the water must come from the Owens valley, 250 miles in a straight line to the northward.

The water board purchased or took options on \$1,000,000 worth of land and water rights solely upon his recommendation, the money being advanced

reservoirs. These, conserving the golden flood during the time of winter rains, when there is least demand, will assure a withdrawal of more than 200,000,000 gallons daily during the five months of the hot, dry summer season. It will thus be seen that much more than half of the aqueduct's capacity can be devoted to irrigation for a very long term of years.

In the San Fernando valley and spreading out directly beneath the two great reservoirs, government reports show that there are from 50,000 to 75,000 acres of fertile lands which can be made highly productive if water can be brought to them. In the San Gabriel, the Chahuenga, and other valleys, this area is increased to more than 200,000 acres—an area furnishing a market for a larger amount of water than the city will have for sale for irrigation purposes. This several hundred square miles of territory, which for years has been included in a few great ranches, each comprising thousands of acres, is being broken up into small ranches averaging not more than 40 acres in anticipation of the coming of water.

These ranches five years ago could have been purchased at from \$10 to \$40 an acre, which is the average value of lands having no prospect of water. Today they are being sold in the San Fernando valley at prices ranging from \$60 to \$200 an acre. Under irrigation and with citrus orchards in bearing, they will command prices ranging from \$1000 to \$1500 an acre, which in the citrus fruit belt is considered an average price.

The increase in the value of these lands has been brought about solely through the city's construction of the aqueduct.

**Power Possibilities.**

The discussion of electric power possibilities has been left for the last for the reason that it deals with revenues and possibilities of civic greatness which are larger than those of either domestic use or irrigation.

The total output of electric energy, in a report made March 4, 1910, by three of the foremost electrical engineers for the purpose of partially developing this large source of income, estimated at 49,000 horse power. The hydro-electric plants are to be constructed and ready for operation at the same time that the aqueduct is opened to the flow of the Owens river.

The present consumption of power for all purposes in the entire county of Los Angeles is estimated as not exceeding 50,000 horse power, of which 55,000 horse power is consumed within Los Angeles city. It will require a long series of years to find a market for such a large amount of power as the city has at its back, and this is recognized by the development of only a fraction of the possible output just at this time.

E. F. Scattergood, the aqueduct's chief electrical engineer, prepared estimates in 1906 for the development of 27,000 horse power at a total cost of \$4,490,000, the power to be delivered at the city's gates. With the sale of power figured at the low wholesale rate of eight-tenths cents per kilowatt hour, on a 50 percent load basis, and accounting for all costs of operation, maintenance, interest on bonds, sinking fund, and depreciation of plant, he placed the net annual revenue at \$1,406,000.

**Reply Whole Cost in 20 Years.**

Mr. Mulholland, in a public utterance on this subject, said: "I believe that the people have in the possible power development from the aqueduct an investment which 20 years hence will turn back into the city treasury the entire \$24,500,000 provided for the construction of the aqueduct, with interest." His declaration is borne out by the hydraulic and electrical engineers who have been called upon to examine the plans and estimates.

**TEXLINE BOY INJURED FROM KICK BY HORSE**

Man Struck and Seriously Wounded on Ranch Near Town; Hand Gets New Instruments; Broom Corn Stored.

Texline, Texas, Sept. 30.—While riding one horse and driving two others at Forten, Texas, Ray Culp, aged 13 years, was kicked under the chin by one of the horses he was driving, break-

ing his jawbone and knocking out several teeth. He was brought to Texline and his injuries attended to by local physicians. Later he was taken to Dalhart to have dental work done.

Word has been received here that John Lewis was stabbed with a knife just below the heart. Lewis has been working for a man named Hyso and owing to some misunderstanding a quarrel resulted. The wounded man's condition is considered serious. The stabbing occurred on Hyso's farm, 15 miles southwest of Texline.

Mrs. W. M. Lytle, who has been visiting with a daughter at Dumas, has returned home.

The fair at Clayton, N. M., attracted so many of the Texline people that the town was almost depopulated for a few days.

The Texline band recently received new instruments and is getting ready to do some loud blowing for the town. O. D. Hall, manager of the Big Jo Lumber company, boasts of a brand new son in his home.

Dr. Burnett, who has been absent for some weeks, returned to Texline this morning, having made the trip from Lamar, Colo.

The first broom corn to be brought to Texline was brought in by G. E. Slayton of near Sedan, N. M. There being no buyers at this place at present, the load was stored until the buyers come.

Carl Pryor, recently of Texline, has been awarded \$8000 in a damage suit which he brought against an electrical company. While employed for this company in Oklahoma City some time ago, he had an accident which caused the loss of an eye. The suit has been in court for several months.

F. S. Spann and R. G. Condon are in Amarillo, figuring with contractors for the new school building for Texline.

**HEAVY RAINS FALL AT ALPINE AND VICINITY**

Plans to Drill for Artesian Water and Oil Formulated; Alpine Girl Marries Sanderson Man.

Alpine, Tex., Sept. 30.—Alpine and surrounding country was visited by a good rain. Reports from Marathon say that that place was visited by a heavy rain and that the ground and valleys especially were solid seas of water. Marfa was also visited by a fine rain.

Wm. Connelly of Los Angeles, Calif., is in Alpine buying cattle for his farm. He has purchased 200 head of steers, 3 years old and up, and 300 head of fat cows, 3 years old and up, from S. R. Guthrie. These are all to be delivered next month. The price for the steers was about \$35 per head and about \$25 per head for the cows.

B. H. Johnson and Miss Lilla Greenwood were married at the home of Mr. and Mrs. Rev. Greenwood. Mr. Johnson is now employed by Joe Kerr of Sanderson, Tex., as bookkeeper, having formerly held a similar position with Mitchell Wert's company of this city, while Miss Greenwood was up to the time of the wedding employed by the Alpine Mercantile company of this place. Mr. and Mrs. Johnson left Saturday night for Sanderson, where they will make their future home. Miss Margaret Trotter has taken the position of dry goods saleswoman for the Alpine Mercantile company which was vacated by Mrs. H. H. Johnson.

Roy Bell sold his residence in the western part of the city to P. W. Kinney, who immediately commenced improving the place. Mr. Bell and his family will likely move to El Paso to make their future home.

Miss Ruth Weakley and her little sister Louise, left for Abilene and Sweetwater and other points to visit relatives and friends for a few months.

Misses Fay and Francis Viars left for a short visit to friends and relatives in east Texas. Mr. and Mrs. J. R. Viars also left the same night for San Antonio, where Mrs. Viars will enter a sanatorium.

The Alpine high school continues to progress. The latest addition is the new school magazine which is to be published monthly. This paper will be edited by the pupils of the Alpine high school and all the contributions will be from the students.

A. B. Weakly left for his old home in Oklahoma, where he expects to spend a month or two attending to his business affairs at that place.

Clay Holland left last week for Waco, where he will attend school. Harry J. Spann left for Waco, where he is employed as head of the vocal department of the Baylor college.

Rev. E. B. Atwood, pastor of the Baptist church here, left for Louisville, Ky., where he will take an advanced course in theology. He was accompanied by his wife and children, who will spend about three months visiting relatives and friends in Kentucky and Tennessee. Rev. C. D. Daniel will preach at the Baptist church here during Mr. Atwood's absence.

G. M. Benson purchased from Mrs. C. E. Sumner one section of land and also one from Mrs. R. T. Meadway. This land is situated on Muskege creek about 13 miles from Alpine. The price it is understood was \$12,500 for the two sections.

P. H. Prue sold 2000 head of 2, 3, 4 and 5 year old steers to Jno. R. Holland for the Kern Cattle company of Los Angeles, Calif.

A McCallum reports the sale of several blocks of land in the Sanford addition.

The movement to put down a deep well for artesian water or oil is gaining ground daily and subscriptions are being taken readily. The promoters hope to have the movement in hand and ready for work in a very short time.

Glenn C. Richards has returned from a visit to his parents at Hasca, Tex., and brings the report that Alpine is not the only place that has been dry and dusty.

Mrs. J. R. Middlebrook has returned from Fort Worth and other eastern points, where she has been visiting relatives and friends. She was accompanied on her return by her sister, Miss Watters, who will attend school in Alpine.

# FOOT BALL! FOOT BALL!

## FOOT BALL!

### SEASON 1910-1911

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